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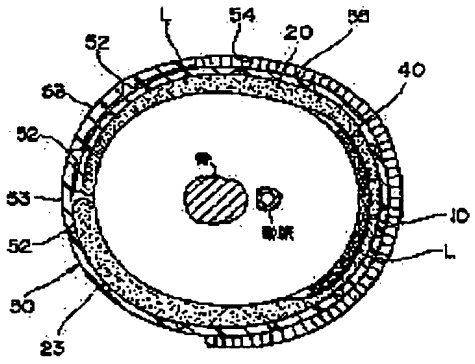
(54) HEMOMANOMETER AND PRESSURE CUFF & BAG THEREOF

(57)Abstract:

PURPOSE: To provide a hemomanometer and a pressure cuff & bag thereof which makes measured values free from effect of a circumferential length of an arm and the width of the pressure cuff & bag to allow accurate measurement of a blood pressure.

CONSTITUTION: This pressure cuff & bag of a hemomanometer is shaped in a belt as a whole and wound on an upper arm to block an arterial bloodstream. This is provided with an inner pressure cuff & bag 10 small relatively to press the artery. an outer pressure cuff & bag 20 which has the inner pressure cuff & bag 10 arranged almost at the center thereof to be wound on the arm, a less viscous leading liquid L to be supplied into or discharged from both the pressure cuff & bags 10 and 20 a pressure sensor which is arranged in the inner pressure cuff & bag 10 to detect changes in pulse wave to be propagated through the leading liquid and in the internal cuff & bag pressure being overlapped and a vibration shielding plate 40 which is interposed between the pressure sensor and the outer pressure cuff & bag 20 to shield the propagation of vibrations as probable disturbance to the inner pressure cuff & bag 10 through the outer pressure cuff & bag 20.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The comparatively small inner cuff which is a cuff of the sphygmomanometer with which the whole is beltlike with a sphygmomanometer, is twisted around an overarm, and carries out ischemia of the artery style, and presses an artery, The outer cuff which arranges said inner cuff in the center of abbreviation, and is twisted around an arm, The pressure sensor which superimposes and detects change of the conduction liquid of low viscosity by which feeding and discarding are carried out according to an individual into said both cuffs, the pulse wave which is arranged in said inner cuff and spread through said conduction liquid, and cuff internal pressure, The cuff characterized by having the oscillating shield which intercepts propagation of the pulse wave to the inner cuff which intervened between said sensors and outer cuffs and minded the outer cuff.
[Claim 2] The sphygmomanometer characterized by having a judgment means to determine the diastole (minimum) blood pressure of blood pressure, and contraction stage (max) blood pressure from the digital output signal of the conduction liquid feeding-and-discarding means to a cuff according to claim 1, and an inner cuff and an outer cuff, the differential circuit which differentiates the output signal of a pressure sensor, the A/D converter which changes the output signal of said differential circuit, or the input signal to said differential circuit into a digital signal, and said A/D converter, or the digital output signal of a differential circuit.
[Claim 3] Said judgment means is a sphygmomanometer according to claim 2 characterized by judging blood pressure just before it made blood pressure when a flat part arises between contiguity pulses in a continuous arterial-wave form into diastole (minimum) blood pressure and the arterial-wave form became zero as contraction stage (max) blood pressure.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] There are the view blood type which measures the pressure in a blood vessel directly, and bloodless [which are measured based on change of the pulsation of a blood vessel changed into the ischemia condition] in blood pressure measurement, and this invention relates to a bloodless sphygmomanometer and its cuff.
[0002]
[Description of the Prior Art] With the conventional bloodless sphygmomanometer, for example, an oscillograph metric type sphygmomanometer, air was supplied to the ********** saccate cuff of rubber, the blood vessel was made into the ischemia condition, the pressure of a cuff and arterial-blood-pressure fluctuation were superimposed and detected on the assumption that the pressure in a cuff was equal to artery compression pressure, and as compared with the clinical data currently beforehand asked for this, the highest or the lowest blood pressure is determined in rule of thumb.
[0003]
[Problem(s) to be Solved by the Invention] However, approximation-like [the blood pressure obtained in the conventional bloodless sphygmomanometer compared with the view blood type] strictly. For this reason, by the time it computes the highest or the lowest blood pressure, various kinds of storage, a judgment, and data processing are required, and structure needs many processes until it is complicated and blood pressure can be found. For example, a comparison calculation means with the memory for clinical data and clinical data etc. is indispensable, and a configuration is dramatically complicated. Moreover, since there are many processes, before blood pressure can be found, time amount will be taken, and since the ischemia condition by the cuff is continued by the operating personnel-ed in the meantime, it is accompanied by pain.
[0004] moreover, the backlash measurement error which is the air to which the cuff for the conventional sphygmomanometers has structure which sends in air in a cuff and carries out ischemia of the blood vessel, and a pulsating transfer medium is rich in compressibility -- being generated -- easy -- current -- if it uses for the man of 32cm or more of overarm peripheries using a cuff with a width of 13cm made proper, actual higher blood pressure will be measured, and when it uses for the man of 28cm or less of overarm peripheries on the other hand, it is in the actual inclination measured lower.
[0005] This invention was not made in view of the trouble of said conventional technique, and the object has measured value in it not being influenced of an arm circumference and cuff width, but offering the possible sphygmomanometer and cuff of exact blood pressure measurement.
[0006]
[Means for Solving the Problem] In the cuff which starts claim 1 in order to attain said object The comparatively small inner cuff which is a cuff of the sphygmomanometer with which the whole is beltlike with a sphygmomanometer, is twisted around an overarm, and carries out ischemia of the artery style, and presses an artery, The outer cuff which arranges said inner cuff in the center of abbreviation, and is twisted around an arm, The pressure sensor which superimposes and detects change of the

conduction liquid of low viscosity by which feeding and discarding are carried out according to an individual into said both cuffs, the pulse wave which is arranged in said inner cuff and spread through said conduction liquid, and cuff internal pressure, It intervenes between said sensors and outer cuffs, and has the oscillating shield which intercepts propagation of the pulse wave to the inner cuff through an outer cuff.

[0007] In the sphygmomanometer concerning claim 2 Moreover, the conduction liquid feeding-and-discarding means to a cuff according to claim 1, and an inner cuff and an outer cuff, The transducer which changes the output signal of a pressure sensor into an electrical signal, The differential circuit which differentiates the output signal of a transducer, and the A/D converter which changes the output signal of said differential circuit, or the input signal to said differential circuit into a digital signal, It has a judgment means to determine the diastole (minimum) blood pressure of blood pressure, and contraction stage (max) blood pressure, from the digital output signal of said A/D converter, or the digital output signal of a differential circuit.

[0008] Moreover, in the sphygmomanometer concerning claim 3, and its cuff, said judgment means judges blood pressure just before it made blood pressure when a flat part arises between contiguity pulses in a continuous arterial-wave form into the inside of diastole (minimum) blood pressure and the arterial-wave form became zero as contraction stage (max) blood pressure.

[0009]

[Function] The inner cuff backed up by the outer cuff presses an artery certainly, it considers as an ischemia condition, and a pressure sensor serves as a location which stands face to face against the ischemia section of an artery. And pulsation of an artery and the pressure fluctuation in an inner cuff are exactly spread to a pressure sensor through the nonviscous conduction liquid in an inner cuff (incompressibility). The signal which serves as disturbance transmitted to an inner cuff side from an outer cuff side is intercepted by the oscillating shield.

[0010]

[Example] Next, the example of this invention is explained based on a drawing. The block diagram in which drawing 1 -6 show the sphygmomanometer which is one example of this invention, the sectional view in the condition that drawing 1 equipped the overarm with the cuff, and drawing 2 show the horizontal sectional view (sectional view in alignment with line II-II shown in drawing 1) of this condition, and drawing 3 shows the configuration of the whole sphygmomanometer, internal-block drawing of CPU whose drawing 4 is a blood-pressure judging means, drawing in which drawing 5 shows a pulse wave form, and drawing 6 are the flow charts in the blood-pressure judging of CPU.

[0011] In these drawings a sphygmomanometer The inner cuff 10 for arterial-blood-pressure Hasama, The pressure sensor 16 which the outside of the inner cuff 10 is prepared in the wrap outer cuff 20 and the inner cuff 10, and superimposes and detects a pulse wave and cuff internal pressure, The feeding-and-discarding means 30 which consists of a pump 31 which carries out the feeding and discarding of the conduction liquid to both the cuffs 10 and 20, respectively, and tubes 32 and 33, It mainly consists of an oscillating shield 40 by which adhesion immobilization was carried out at the outside surface of the inner cuff 10, and a processing circuit 50 which processes the output which the pressure sensor 16 detected and asks for diastole (minimum) blood pressure and contraction stage (max) blood pressure.

[0012] It is set to an overarm so that an artery may be crossed the inner cuff 10 being used as saccate, and the pressure sensor 16 formed in the cuff 10 interior detects pulsating change of an artery with the pressure in the inner cuff 10 (compression pressure). Since the outer cuff 20 presses the inner cuff 10 on an arm, it is not required that ischemia should be carried out only for itself [inner cuff 10]. The appearances of the inner cuff 10 are the shape of a rectangle (long [as an example / 3cm wide, 6cm (long)]), and bag structure, and inside (adhesion-on arm side) construction material uses the high vinyl chloride of flattery nature, and, thereby, is good. [of the transmissibility of vibration of a pulse wave] Moreover, the flattery nature currently generally used is formed in this kind of cuff of small a little thick vinyl chloride, and the construction material of the outside of the inner cuff 10 is effective when preventing propagation of the oscillation used as disturbance, such as a pulse wave spread through the outer cuff 20.

[0013] The appearance of the outer cuff 20 is band-like bag structure with a width of 13cm, the inside and an outside are formed of the small vinyl chloride of elasticity, and the feeding and discarding of the conduction liquid are carried out to the interior. Moreover, in the inner cuff 10, the outer cuff 20 is formed according to an individual, and has the operation which backs up the inner cuff 10 and carries out ischemia of the artery style. The conduction liquid L supplied to the inner cuff 10 and the outer cuff 20 has low viscous and incompressible pure water, silicone oil, liquid chlorofluocarbon, usable alcohol, etc. as a liquid with convective [of pulsation / good].

[0014] A pressure sensor 16 is diaphram structure, the electrical signal corresponding to pressure variation is outputted, transducer 16a changed into an electrical potential difference is built in, and it is held in the outer cuff 20 side in the inner cuff 10 in consideration of wiring of lead wire 18 in order to secure ischemia. The oscillating shield 40 was formed in 3cm wide and about 6cm long by the product made of resin, is not to transmit the oscillation used as disturbance, such as pulsation from the outer cuff 20 side, to the pressure sensor 16 in the inner cuff 10, and is pasted up on the outside of the inner cuff 10 so that the inner cuff 10 may be covered. Unnecessary signals other than pulsation required for blood pressure measurement and compression pressure are also detected simultaneously, and after that, although it had become the structure which eliminates an unnecessary signal to a blood-pressure judging, since the oscillation (signal) which acts on the pressure sensor 16 in the inner cuff 10 as disturbance is intercepted by existence of this oscillating shield 40, only a signal required for a blood-pressure judging is conventionally detectable by this example.

[0015] A pump 31 carries out the feeding and discarding of the conduction liquid L to the inner cuff 10 and the outer cuff 20 through tubes 32 and 33, respectively, and can consider electromagnetic, an air type, etc. The tube 32 which connects the outer cuff 20 with a pump 31 branches on the way, and the thin tube 33 prolonged from this tee is connected to the inner cuff 10. That is, while the tube 32 which connects the inner cuff 10 and the outer cuff 20 is made fine, tubes 32 and 33 are formed according to the small construction material of flattery nature, for example, polyethylene, and it is hard to come spread the pulsation spread to the outer cuff 20 to the inner cuff 10 through the inside of a tube 32 and 33.

[0016] The flexible covering 50 with which adhesion immobilization of the edge was carried out at the outer cuff 20 is formed in the outside of the outer cuff 20. This covering 50 is the structure where the strip pieces 53 made of resin were formed successively at equal intervals through the light-gage hinge region 52, and can be easily transformed into cylindrical. Moreover, the piece-of-Velcro section currently formed in the other end side of covering 50 is shown, the hair transplantation field 55 of the outside surface of covering 50 is pasted, covering 50 carries out envelopment adhesion at the peripheral face of the outer cuff 20, prevents the deformation to the outside of the outer cuff 20, and a sign 54 has the work which raises the ischemia operation by the outer cuff 20.

[0017] Drawing 3 is the block diagram showing the whole sphygmomanometer configuration, and the output (analog signal) of a pressure sensor 16 is amplified by the amplifier 17, it is changed into a digital signal by A/D converter 18, and is inputted into CPU19 which is the data-processing section. CPU19 is connected to 19d of switches which display RAM19a which can be written, ROM19b which can memorize data, the diastole (minimum) blood pressure computed based on the blood-pressure data inputted from A/D converter 18, and this blood-pressure data, contraction stage (highest) blood pressure, etc., such as indicator 19c, an application-of-pressure switch, and an electric power switch. In addition, CPU19 is connectable also with external material machine 19e, such as a personal computer. A sign 34 is a pump actuation circuit, and it operates in order to make a pump 31 drive based on the signal from CPU19.

[0018] Drawing 4 is internal-block drawing of CPU19, a sign 61 is a differential circuit and the output of this differential circuit 60 serves as an output wave as shown in the drawing 5 sign A. A sign 62 is the 1st comparison circuit and is outputted to an absolute-value circuit 63 here. In this circuit, a differential value is made into an absolute value and the output wave of this circuit 63 turns into an output wave as shown in the drawing 5 sign B. Furthermore, the output of a circuit 63 is outputted to the 2nd comparison circuit 64, and the absolute value of a differential value is compared [whether it is zero or

more and]. Moreover, 0 responds for whether being no and, as for the output of this circuit 64, an absolute value is alternatively outputted to the distinction circuits 65 and 66. In a circuit 65, it distinguishes whether the absolute value of a differential value is 0 of the beginning, and at the time of YES, it is outputted to a store circuit 67 and DBP (diastolic blood pressure) is memorized here. On the other hand, in a circuit 66, it distinguishes whether 0 which is the absolute value of a differential value continued for 2 - 3 seconds, and at the time of YES, it is outputted to a store circuit 67 and SBP (systolic blood pressure) is memorized here.

[0019] Moreover, drawing 6 shows the flow chart in the blood-pressure judging of CPU19. In step 70, A/D conversion is carried out first, and it shifts to step 71 which is a differential circuit 61. At this step 71, while differentiating data, difference deltaVi with the data which carried out A/D conversion before one is computed. And it shifts to step 72 which is the 1st comparison circuit 62. At this step 72, it distinguishes whether it is forward, and in a forward case, deltaVi shifts to step 74 which is the 2nd comparison circuit 64 (as shown in the sign a in drawing 5 , when the inclination of a pulse wave is forward). On the other hand, when deltaVi is negative, it shifts to step 73 which is an absolute-value circuit 63 (as shown in the sign b in drawing 5 , when the inclination of a pulse wave is negative), the absolute value of data is taken here, and it shifts to step 74 which is the 2nd comparison circuit. At step 74, |deltaVi| distinguishes whether it is forward, and if it is forward, it will return to step 70. On the other hand, in step 73, it shifts to step 75 at the time of |deltaVi|=0. At step 75, it distinguishes whether it began and was set to deltaVi=0, if it is YES, the cuff pressure at this time will be set to DBP (diastolic blood pressure), and it shifts to step 72 which is a store circuit, this DBP is memorized, and it returns to step 70 again. On the other hand, when deltaVi=0 is the 2nd more than time in step 75, it shifts to step 76 which is the distinction circuit 66, and distinguishes whether deltaVi=0 is continuing more than several seconds (2 - 3 seconds). And if it is YES, the last cuff pressure at the time of deltaVi>0 will be set to SBP (systolic blood pressure), it shifts to step 78, this SBP is memorized, and a judgment is completed.

[0020] Drawing 5 is drawing showing the inner cuff pressure and view blood blood-pressure wave between contraction blood-pressure (SBP) order fields, and the pulse wave form of an inner cuff from a diastolic blood pressure (DBP). The pulse wave form where a view blood blood-pressure wave and Sign D appear [Sign C] in an inner cuff in in this drawing, and Sign E are inner cuff pressures. And below by DBP, although the pulse wave form D appears continuously, since a pulse wave form lower than the inner cuff pressure force E is omitted, it becomes discontinuous [the pulse wave form D] between SBP from DBP. That is, a flat part D1 appears between contiguity pulse wave forms, and one-beat before at the time of the appearance of this first flat part is DBP. Moreover, although the pulse wave form D becomes small with lifting of cuff pressure E, among those it disappears, it is SBP one beat before this pulse wave form D is extinguished.

[0021] In addition, although it is the configuration of differentiating the digital signal changed with A/D converter 18 by the differential circuit 61 in CPU19, you may make it prepare a differential circuit between amplifier 17 and A/D converter 18 in said said example.

[0022]

[Effect of the Invention] According to the sphygmomanometer using the cuff concerning this invention, and this cuff pressure, so that clearly from the above explanation The inner cuff backed up by the outer cuff presses an artery certainly, and considers as an ischemia condition. A pressure sensor serves as a location which stands face to face against an artery, and, moreover, pulsation and pressure fluctuation spread exactly to a pressure sensor through the nonviscous conduction liquid in an inner cuff (incompressibility). And since the oscillation which it is going to spread from an outer cuff side to an inner cuff side is certainly intercepted by the oscillating shield, the blood pressure measurement exact few always of the error on measurement by the width and the arm circumference of a cuff differing from each other becomes possible.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing of longitudinal section in the condition of having equipped the overarm with the cuff of the sphygmomanometer which is one example of this invention
[Drawing 2] The horizontal sectional view of this condition (sectional view in alignment with line II-II shown in drawing 1)
[Drawing 3] The block diagram showing the whole sphygmomanometer configuration
[Drawing 4] Internal-block drawing of CPU which is a blood-pressure judging means
[Drawing 5] Drawing showing a pulse wave form
[Drawing 6] The flow chart in the blood-pressure judging of CPU
[Description of Notations]
10 Inner Cuff
16 Pressure Sensor
18 A/D Converter
19 CPU Which is Judgment Means
20 Outer Cuff
30 Conduction Liquid Feeding-and-Discarding Means
31 Pump
32 33 Tube
40 Oscillating Shield
61 Differential Circuit
L Conduction liquid

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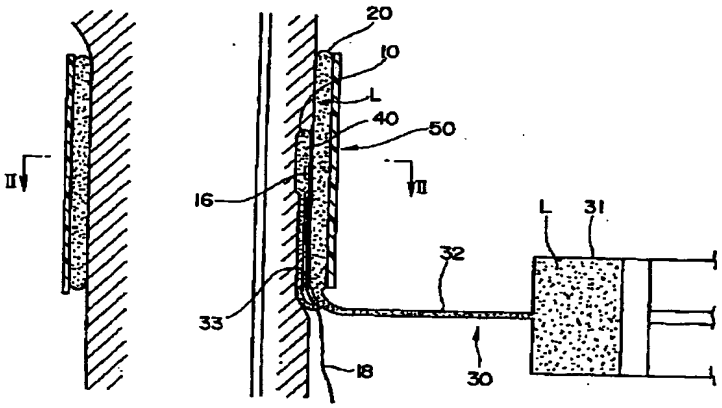
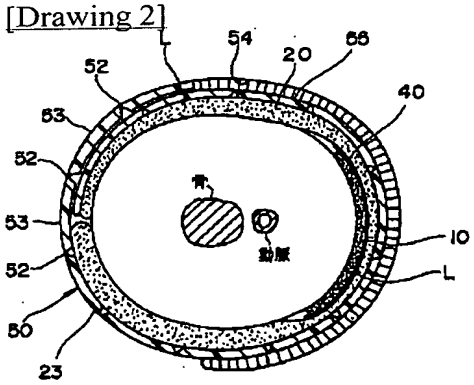
DRAWINGS

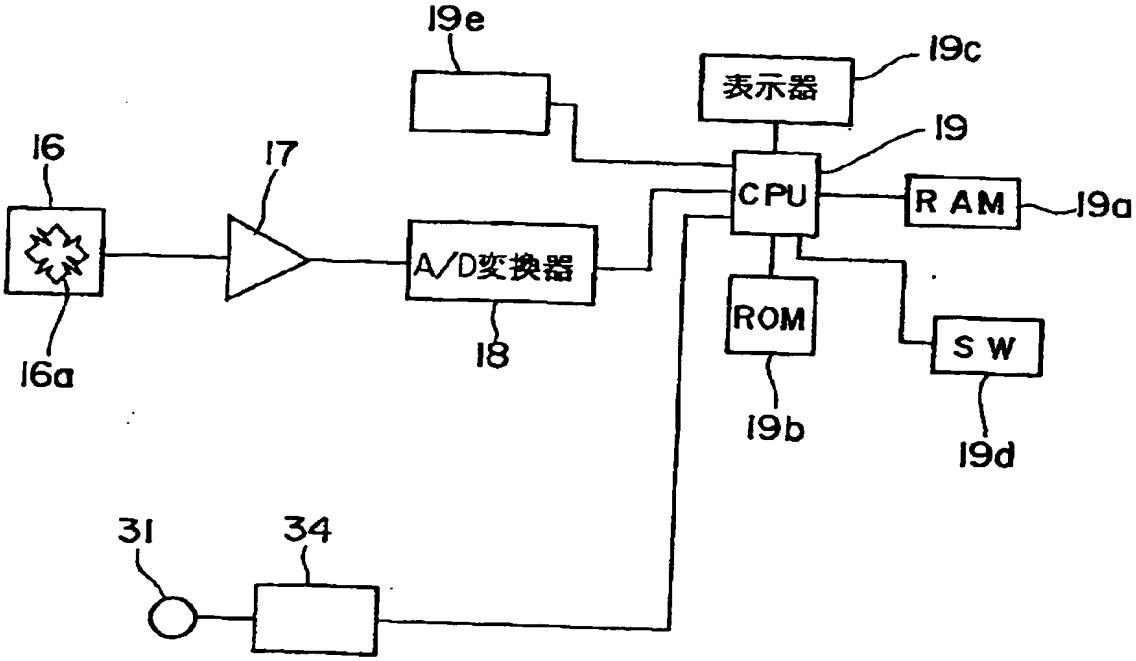
[Drawing 1]



[Drawing 2]



[Drawing 3]



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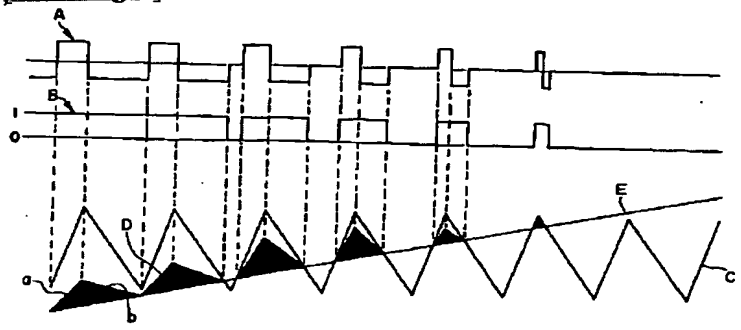
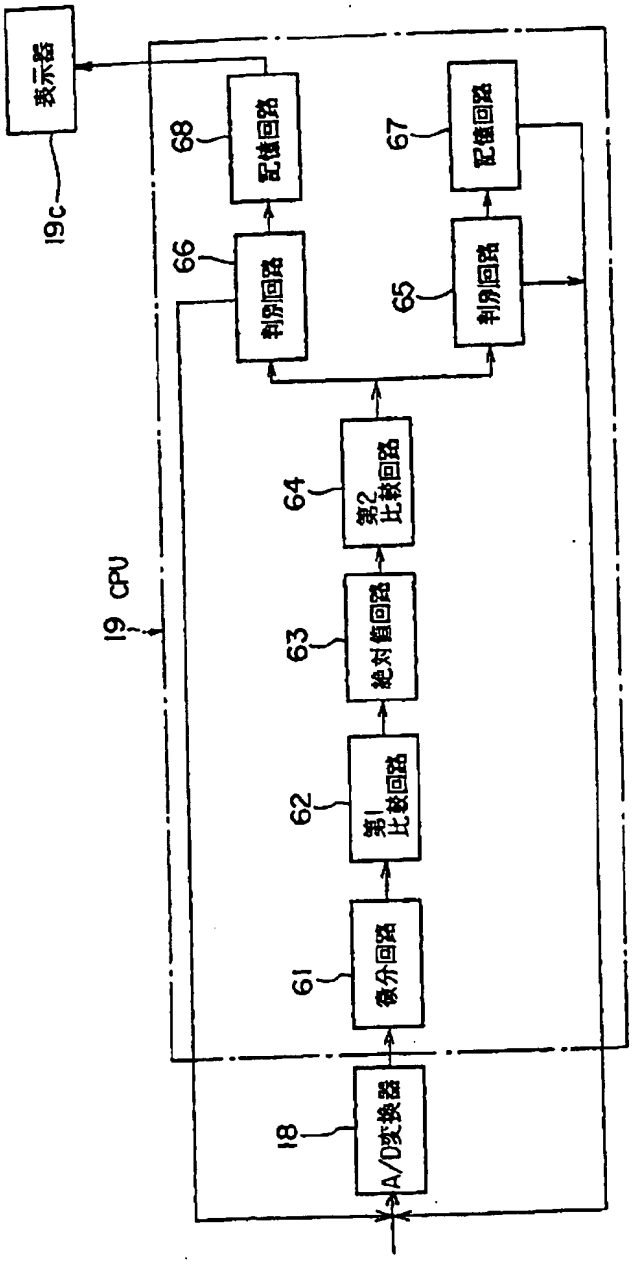
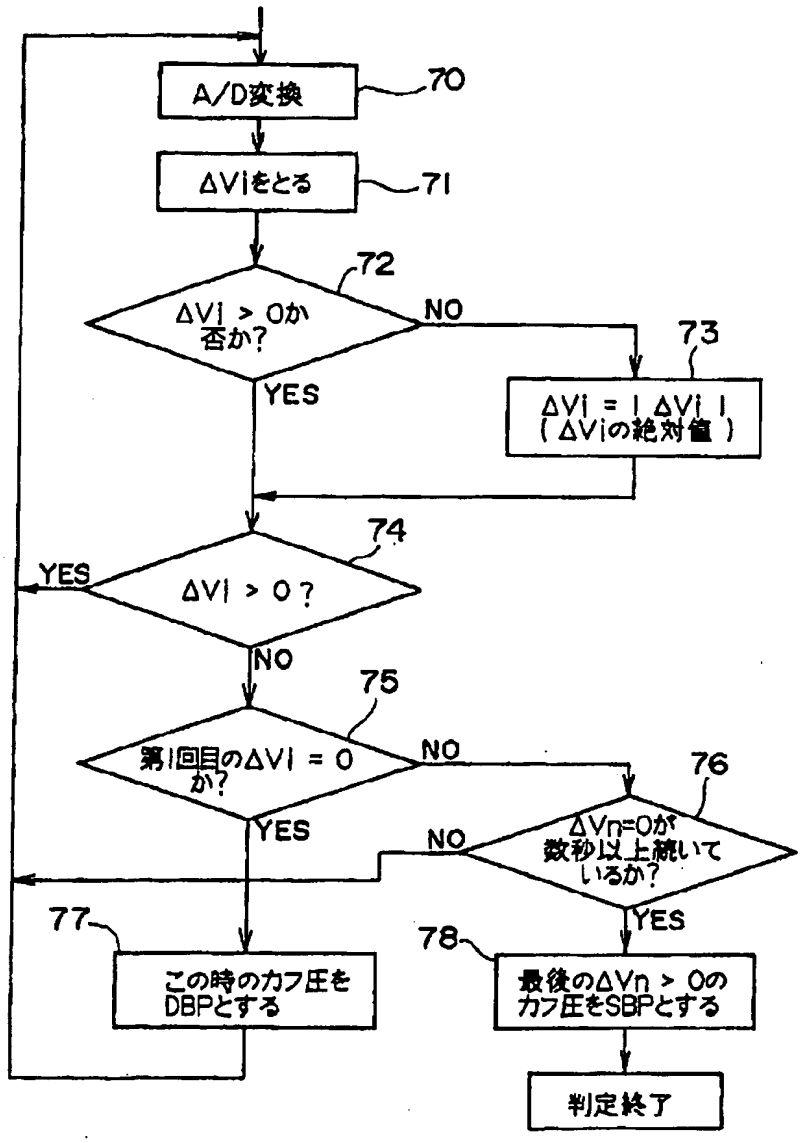


[Drawing 4]


表示器
19c
19 CPU
68
記憶回路
67
記憶回路
66
判別回路
65
判別回路
64
第2比較回路
63
絶対値回路
62
第1比較回路
61
微分回路
18
A/D変換器

[Drawing 6]



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		8932－4C		３３５　Ｃ	

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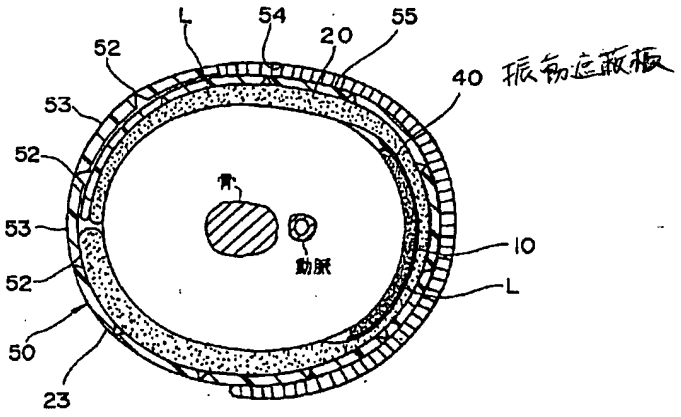
(54)【発明の名称】　血圧計とそのカフ

(57)【要約】
【目的】　測定値が腕周長とカフ巾の影響を受けず正確な血圧測定の可能な血圧計とそのカフの提供。
【構成】　全体が帯状で上腕に巻きつけられ、動脈流を阻血する血圧計のカフであって、動脈を圧迫する比較的小さなインナーカフ１０と、インナーカフ１０を略中央に配置し、腕に巻き付けられるアウターカフ２０と、両カフ１０，２０内に個別に給排される低粘性の伝導液Ｌと、インナーカフ１０内に配置され、伝導液を介して伝播される脈波とカフ内圧の変化を重畳して検出する圧力センサー１６と、圧力センサー１６とアウターカフ２０間に介在され、アウターカフ２０を介したインナーカフ１０への外乱となる振動の伝播を遮断する振動遮蔽板４０と、を備えるようにした。



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【特許請求の範囲】

【請求項１】　全体が帯状で上腕に巻きつけられ、動脈流を阻血する血圧計のカフであって、動脈を圧迫する比較的小さなインナーカフと、前記インナーカフを略中央に配置し、腕に巻き付けられるアウターカフと、前記両カフ内に個別に給排される低粘性の伝導液と、前記インナーカフ内に配置され、前記伝導液を介して伝播される脈波とカフ内圧の変化を重畳して検出する圧力センサーと、前記センサーとアウターカフ間に介在され、アウターカフを介したインナーカフへの脈波の伝播を遮断する振動遮蔽板と、を備えたことを特徴とするカフ。

【請求項２】　請求項１記載のカフと、インナーカフとアウターカフへの伝導液給排手段と、圧力センサーの出力信号を微分する微分回路と、前記微分回路の出力信号又は前記微分回路への入力信号をデジタル信号に変換するＡ／Ｄ変換器と、前記Ａ／Ｄ変換器のデジタル出力信号又は微分回路のデジタル出力信号から血圧の拡張期（最低）血圧と収縮期（最大）血圧を決定する判定手段と、を備えたことを特徴とする血圧計。

【請求項３】　前記判定手段は、連続する動脈波形中において、隣接脈間に平坦部が生じた時の血圧を拡張期（最低）血圧とし、また動脈波形が零となった直前の血圧を収縮期（最大）血圧として判定することを特徴とする請求項２記載の血圧計。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】血圧測定には血管内の圧力を直接測定する観血式と、阻血状態にした血管の脈動の変化に基づいて測定する非観血式とがあり、本発明は非観血式の血圧計及びそのカフに関する。

【０００２】

【従来の技術】従来の非観血式血圧計、例えばオシロメトリック式血圧計では、ゴムのうとよばれる袋状のカフに空気を供給して血管を阻血状態とし、カフ内の圧力が動脈圧迫圧と等しいことを前提としてカフの圧力と動脈圧変動とを重畳して検出し、これを予め求められている臨床データと比較して、経験則的に最高又は最低血圧を決定している。

【０００３】

【発明の解決しようとする課題】しかし従来の非観血式血圧計では、観血式に比べると、得られた血圧はあくまでも近似的なものにすぎない。このため最高又は最低血圧を算出するまでには各種の記憶，判定，演算処理が必要で、構造は複雑で血圧が求まるまで多くの工程を必要とする。例えば臨床データ用メモリー、臨床データとの比較算出手段等が不可欠で、構成が非常に複雑である。また工程が多いため血圧が求まるまでに時間がかかり、被測定者にはその間カフによる阻血状態が継続されるため苦痛を伴う。

【０００４】また従来の血圧計用のカフはカフ内に空気を送り込んで血管を阻血する構造となっており、脈動伝達媒体が圧縮性に富む空気であるがため測定誤差が生じ易く、現在適正であるとされる巾１３cmのカフを使って上腕周３２cm以上の人に使用すると実際より高い血圧が測定され、一方上腕周２８cm以下の人に使用すると実際より低く測定される傾向にある。

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【０００５】本発明は前記従来技術の問題点に鑑みなされたもので、その目的は、測定値が腕周長とカフ巾の影響を受けず正確な血圧測定の可能な血圧計とそのカフを提供することにある。

【０００６】

【課題を解決するための手段】前記目的を達成するために、請求項１に係るカフにおいては、全体が帯状で上腕に巻きつけられ、動脈流を阻血する血圧計のカフであって、動脈を圧迫する比較的小さなインナーカフと、前記インナーカフを略中央に配置し、腕に巻き付けられるアウターカフと、前記両カフ内に個別に給排される低粘性の伝導液と、前記インナーカフ内に配置され、前記伝導液を介して伝播される脈波とカフ内圧の変化を重畳して検出する圧力センサーと、前記センサーとアウターカフ間に介在され、アウターカフを介したインナーカフへの脈波の伝播を遮断する振動遮蔽板と、を備えるようにしたものである。

【０００７】また請求項２に係る血圧計においては、請求項１記載のカフと、インナーカフとアウターカフへの伝導液給排手段と、圧力センサーの出力信号を電気信号に変換するトランスデューサーと、トランスデューサーの出力信号を微分する微分回路と、前記微分回路の出力信号又は前記微分回路への入力信号をデジタル信号に変換するＡ／Ｄ変換器と、前記Ａ／Ｄ変換器のデジタル出力信号又は微分回路のデジタル出力信号から血圧の拡張期（最低）血圧と収縮期（最大）血圧を決定する判定手段と、を備えるようにしたものである。

【０００８】また請求項３に係る血圧計とそのカフにおいては、前記判定手段は、連続する動脈波形中において、隣接脈間に平坦部が生じたときの血圧を拡張期（最低）血圧中とし、また動脈波形が零となった直前の血圧を収縮期（最大）血圧として判定するようにしたものである。

【０００９】

【作用】アウターカフにバックアップされたインナーカフが動脈を確実に圧迫して阻血状態とし、圧力センサーは動脈の阻血部に対峙する位置となる。そして動脈の脈動及びインナーカフ内の圧力変動はインナーカフ内の非粘性の伝導液（非圧縮性）を介して圧力センサーに的確に伝播される。アウターカフ側からインナーカフ側に伝達される外乱となる信号は振動遮蔽板によって遮断される。

【００１０】

【実施例】次に、本発明の実施例を図面に基づいて説明

する。図１～６は本発明の一実施例である血圧計を示し、図１はカフを上腕に装着した状態の断面図、図２は同状態の水平断面図（図１に示す線II－IIに沿う断面図）、図３は血圧計全体の構成を示すブロック図、図４は血圧判定手段であるＣＰＵの内部ブロック図、図５は脈波形を示す図、図６はＣＰＵの血圧判定におけるフローチャートである。

【００１１】これらの図において、血圧計は、動脈圧迫用のインナーカフ１０と、インナーカフ１０の外側を覆うアウターカフ２０と、インナーカフ１０内に設けられて脈波とカフ内圧を重畳して検出する圧力センサー１６と、両カフ１０，２０にそれぞれ伝導液を給排するポンプ３１とチューブ３２，３３からなる給排手段３０と、インナーカフ１０の外表面に接着固定された振動遮蔽板４０と、圧力センサー１６の検出した出力を処理して拡張期（最低）血圧と収縮期（最大）血圧とを求める処理回路５０とから主として構成されている。

【００１２】インナーカフ１０は、袋状とされて動脈を横断するように上腕にセットされ、カフ１０内部に設けられた圧力センサー１６がインナーカフ１０内の圧力（圧迫圧）とともに動脈の脈動変化を検出する。アウターカフ２０がインナーカフ１０を腕に圧迫するので、インナーカフ１０自身のみで阻血することは要求されない。インナーカフ１０の外形は矩形状（例として横３ｃｍ、縦６ｃｍ）、かつ袋構造で、内側（腕への密着側）の材質は追従性の高い塩化ビニールを用いており、これにより脈波の振動伝達率が良好である。またインナーカフ１０の外側の材質は、この種のカフに一般に使用されている追従性が小さくやや厚い塩化ビニールによって形成されており、アウターカフ２０を介して伝播される脈波等の外乱となる振動の伝播を阻止する上で有効である。

【００１３】アウターカフ２０の外形は巾１３ｃｍの帯状袋構造で、内側および外側ともに伸縮性の小さい塩化ビニールによって形成され、内部には伝導液が給排される。またアウタカフ２０はインナーカフ１０とは個別に形成されて、インナーカフ１０をバックアップして動脈流を阻血する作用がある。インナーカフ１０及びアウターカフ２０に供給される伝導液Ｌは、脈動の伝達性良好な液体として、低粘性および非圧縮性の純水，シリコン油，液体フロン，アルコールなどが使用可能である。

【００１４】圧力センサ１６はダイヤフラム構造で、圧力変化に対応した電気信号を出力するもので、電圧に変換するトランスデューサ１６ａが内蔵されており、阻血を確保するために、またリード線１８の配線を考慮して、インナーカフ１０内のアウターカフ２０側に収容されている。振動遮蔽板４０は、インナーカフ１０を覆うように、樹脂製で横３ｃｍ、縦６ｃｍ程度に形成され、インナーカフ１０内の圧力センサー１６にアウターカフ２０側からの脈動等の外乱となる振動が伝達されないようにするためのもので、インナーカフ１０の外側に接着されている。

従来は血圧測定に必要な脈動と圧迫圧以外の不必要な信号も同時に検出し、その後、血圧判定に不要な信号を排除する構造となっていたが、本実施例では、この振動遮蔽板４０の存在によって、インナーカフ１０内の圧力センサー１６に外乱として作用する振動（信号）が遮断されるため、血圧判定に必要な信号のみを検出できる。

【００１５】ポンプ３１は、チューブ３２，３３を介して伝導液Ｌをインナーカフ１０とアウターカフ２０にそれぞれ給排するもので、電磁式、エア式などが考えられる。ポンプ３１とアウターカフ２０を接続するチューブ３２は途中で分岐され、この分岐部から延びる細いチューブ３３がインナーカフ１０に接続されている。即ちインナーカフ１０とアウターカフ２０とを連絡するチューブ３２が細くされるとともに、チューブ３２，３３が追従性の小さい材質、例えばポリエチレンで形成されて、アウターカフ２０に伝播された脈動がチューブ３２，３３内を介してインナーカフ１０に伝播されにくいようになっている。

【００１６】アウターカフ２０の外側には、端部がアウターカフ２０に接着固定されたフレキシブルカバー５０が設けられている。このカバー５０は、薄肉ヒンジ部５２を介して樹脂製ストリップ片５３が等間隔に連設された構造で、容易に円筒型に変形できる。また符号５４はカバー５０の他端部側に形成されているマジックテープ部を示し、カバー５０の外表面の植毛領域５５に接着されて、カバー５０がアウターカフ２０の外周面に包囲密着し、アウターカフ２０の外側への変形を防止して、アウターカフ２０による阻血作用を高める働きがある。

【００１７】図３は血圧計の全体構成を示すブロック図で、圧力センサー１６の出力（アナログ信号）は増幅器１７により増幅され、Ａ／Ｄ変換器１８によってデジタル信号に変換されて演算処理部であるＣＰＵ１９に入力される。ＣＰＵ１９は読み書き可能なＲＡＭ１９ａと、データを記憶できるＲＯＭ１９ｂと、Ａ／Ｄ変換器１８から入力した血圧データや、この血圧データに基づいて算出された拡張期（最低）血圧と収縮期（最高）血圧等を表示する表示器１９ｃ、加圧スイッチや電源スイッチ等のスイッチ類１９ｄに接続されている。なおＣＰＵ１９はパソコン等の外部機器１９ｅにも接続できる。符号３４はポンプ駆動回路で、ＣＰＵ１９からの信号に基づいてポンプ３１を駆動させるべく作動する。

【００１８】図４はＣＰＵ１９の内部ブロック図で、符号６１は微分回路で、この微分回路６０の出力は図５符号Ａに示すような出力波形となる。符号６２は第１の比較回路で、ここに絶対値回路６３に出力される。この回路では、微分値を絶対値とし、この回路６３の出力波形は図５符号Ｂに示すような出力波形となる。さらに回路６３の出力は第２の比較回路６４に出力されて、微分値の絶対値が０以上か否か比較される。またこの回路６４

の出力は絶対値が０が否かに応じて判別回路６５，６６に択一的に出力される。回路６５では微分値の絶対値が最初の０であるか否かを判別し、ＹＥＳのときは記憶回路６７に出力されてここにＤＢＰ（拡張期血圧）が記憶される。一方、回路６６では微分値の絶対値である０が２～３秒間継続したか否かを判別しＹＥＳのときは、記憶回路６７に出力されてここにＳＢＰ（収縮期血圧）が記憶される。

【００１９】また図６はＣＰＵ１９の血圧判定におけるフローチャートを示している。まずステップ７０においてＡ／Ｄ変換され、微分回路６１であるステップ７１に移行する。このステップ７１では、データを微分するとともに１つ前にＡ／Ｄ変換したデータとの差ΔＶｉを算出する。そして第１の比較回路６２であるステップ７２に移行する。このステップ７２ではΔＶｉが正か否かを判別し、正の場合（図５における符号ａに示すように脈波の傾きが正の場合）には、第２の比較回路６４であるステップ７４に移行する。一方、ΔＶｉが負の場合（図５における符号ｂに示されるように脈波の傾きが負の場合）には、絶対値回路６３であるステップ７３に移行し、ここでデータの絶対値がとられて、第２の比較回路であるステップ７４に移行する。ステップ７４では、｜ΔＶｉ｜が正か否かを判別し、正であればステップ７０に戻る。一方、ステップ７３において｜ΔＶｉ｜＝０のときはステップ７５に移行する。ステップ７５では、始めてΔＶｉ＝０となったか否かを判別し、ＹＥＳであればこの時のカフ圧をＤＢＰ（拡張期血圧）とし、記憶回路であるステップ７２に移行し、このＤＢＰを記憶し、再びステップ７０に戻る。一方、ステップ７５においてΔＶｉ＝０が２回目以上の場合には、判別回路６６であるステップ７６に移行し、ΔＶｉ＝０が数秒（２～３秒）以上継続しているか否かを判別する。そしてＹＥＳであれば最後のΔＶｉ＞０の時のカフ圧をＳＢＰ（収縮期血圧）とし、ステップ７８に移行してこのＳＢＰを記憶し、判定が終了する。

【００２０】図５は、拡張期血圧（ＤＢＰ）から収縮血圧（ＳＢＰ）前後領域間におけるインナーカフ圧と観血血圧波形とインナーカフの脈波形を示す図である。この図中の中で、符号Ｃが観血血圧波形、符号Ｄがインナーカフ内に表われる脈波形、符号Ｅがインナーカフ圧である。そしてＤＢＰ以下では、脈波形Ｄは連続的に表われるが、ＤＢＰからＳＢＰ間では、インナーカフ圧力Ｅより低い脈波形がカットされるため、脈波形Ｄが不連続となる。即ち隣接脈波形間に平坦部D_1が出現し、この最初の平坦部の出現時の一拍前がＤＢＰである。またカフ圧Ｅの上昇に伴って脈波形Ｄは小さくなってそのうち消滅するが、この脈波形Ｄが消滅する一拍前がＳＢＰである。

【００２１】なお前記前記実施例においては、Ａ／Ｄ変換器１８によって変換したデジタル信号をＣＰＵ１９内の微分回路６１によって微分する構成であるが、増幅器１７とＡ／Ｄ変換器１８との間に微分回路を設けるようにしてもよい。

【００２２】

【発明の効果】以上の説明から明らかなように、本発明に係るカフおよびこのカフ圧を用いた血圧計によれば、アウターカフにバックアップされたインナーカフが動脈を確実に圧迫して阻血状態とし、圧力センサーは動脈に対峙する位置となり、しかもインナーカフ内の非粘性の伝導液（非圧縮性）を介して脈動及び圧力変動が圧力センサーに的確に伝播され、しかもアウターカフ側からインナーカフ側に伝播しようとする振動は振動遮蔽板によって確実に遮断されるので、カフの巾や腕周長が異なることによる測定上の誤差が少なく常に正確な血圧測定が可能となる。

【図面の簡単な説明】

【図１】本発明の一実施例である血圧計のカフを上腕に装着した状態の縦断面図

【図２】同状態の水平断面図（図１に示す線II－IIに沿う断面図）

【図３】血圧計の全体構成を示すブロック図

【図４】血圧判定手段であるＣＰＵの内部ブロック図

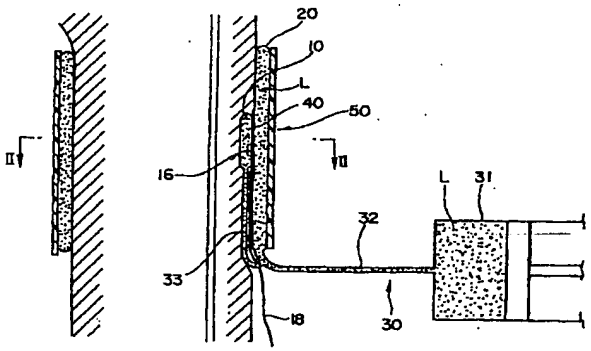
【図５】脈波形を示す図

【図６】ＣＰＵの血圧判定におけるフローチャート

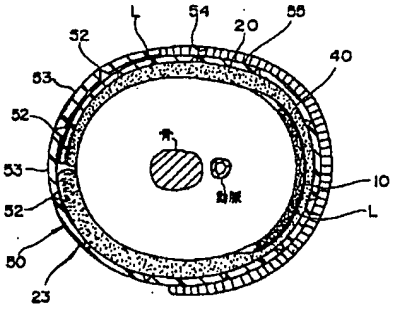
【符号の説明】

１０　インナーカフ
１６　圧力センサ
１８　Ａ／Ｄ変換器
１９　判定手段であるＣＰＵ
２０　アウターカフ
３０　伝導液給排手段
３１　ポンプ
３２，３３　チューブ
４０　振動遮蔽板
６１　微分回路
Ｌ　伝導液

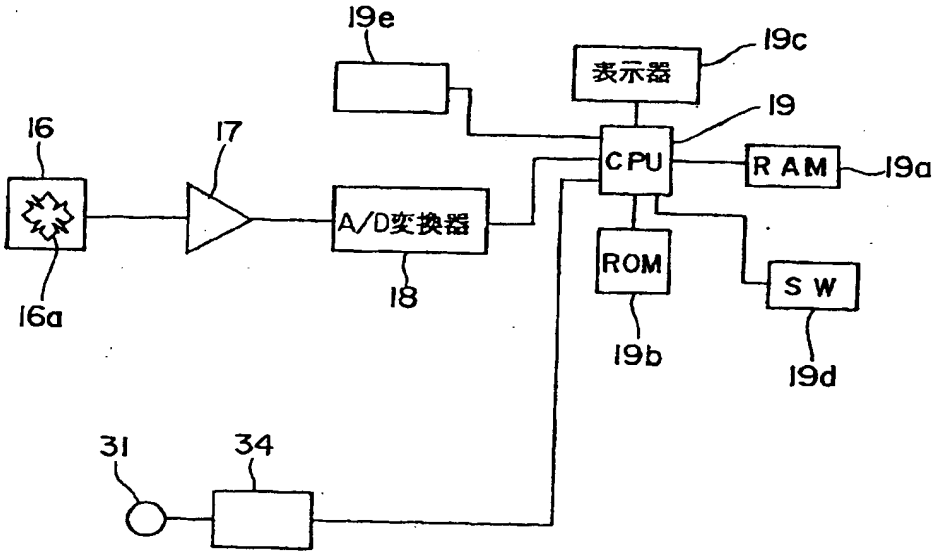
【図１】


20
10
L
40
50
II
II
16
L
31
32
33
18
30

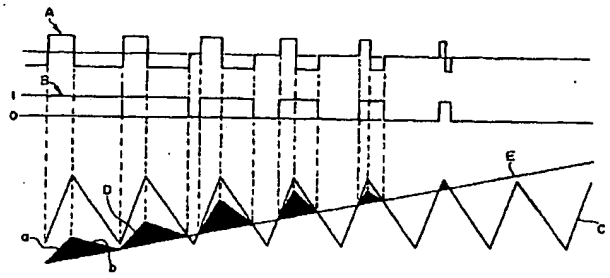
【図２】


L
54
20
55
52
40
53
52
53
10
52
L
50
23

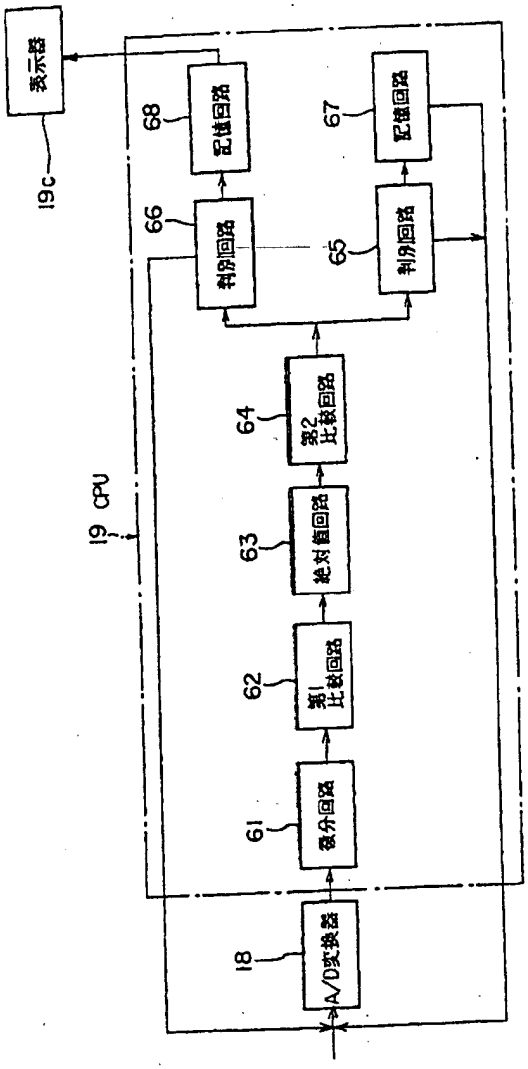
【図３】


19e
表示器
19c
19
16
17
CPU
RAM
19a
A/D変換器
ROM
SW
16a
18
19b
19d
31
34

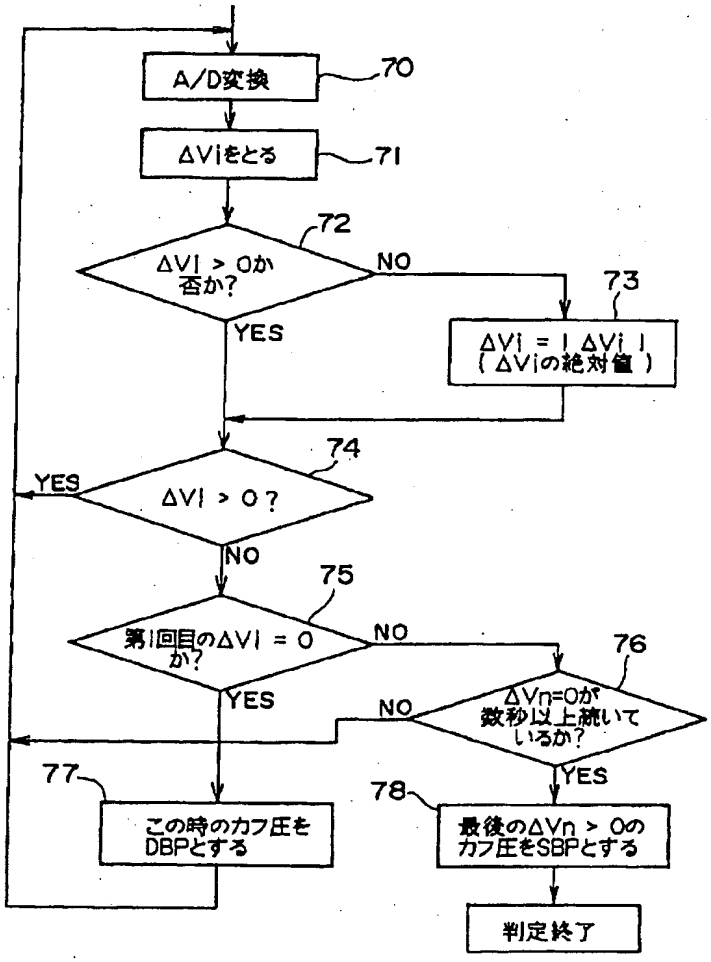
【図５】


A
B
0
E
D
a
b
c

【図4】


表示器
19c
19 CPU
68
記憶回路
67
記憶回路
66
判別回路
65
判別回路
64
第2比較回路
63
絶対値回路
62
第1比較回路
61
微分回路
18
A/D変換器

【図６】


A/D変換
70
ΔViをとる
71
72
ΔVi > 0か
否か?
NO
YES
73
ΔVi = | ΔVi |
(ΔViの絶対値)
74
YES
ΔVi > 0 ?
NO
75
第1回目のΔVi = 0
か?
NO
YES
76
ΔVn=0が
数秒以上続いて
いるか?
NO
YES
77
この時のカフ圧を
DBPとする
78
最後のΔVn > 0の
カフ圧をSBPとする
判定終了